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MSSM-inflation revisited: Towards a coherent description of high-energy physics and cosmology

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The aim of this paper is to highlight the challenges and potential gains surrounding a coherent description of physics from the high-energy scales of inflation down to the lower energy scales probed in particle-physics experiments. As an example, we revisit the way inflation can be realised within an effective Minimal Supersymmetric Standard Model (eMSSM), in which the LLe and udd flat directions are lifted by the combined effect of soft-supersymmetric-breaking masses already present in the MSSM, together with the addition of effective non-renormalizable operators. We clarify some features of the model and address the question of the one-loop Renormalization Group improvement of the inflationary potential, discussing its impact on the fine-tuning of the model. We also compare the parameter space that is compatible with current observations (in particular the amplitude, A_s, and the spectral index, n_s, of the primordial cosmological fluctuations) at tree level and at one loop, and discuss the role of reheating. Finally we perform combined fits of particle and cosmological observables (mainly A_s, n_s, the Higgs mass, and the cold-dark-matter energy density) with the one-loop inflationary potential applied to some examples of dark-matter annihilation channels (Higgs-funnel, Higgsinos and A-funnel), and discuss the status of the ensuing MSSM spectra with respect to the LHC searches. [arXiv:2304.04534, Phys.Rev.D 108, 023511 (2023)]

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